

c/o Santa Barbara Museum of Natural History
2559 Puesta del Sol Road, Santa Barbara, California 93105

DISTRIBUTION OF *SHIJIMIAEOIDES RITA*,
ESPECIALLY *S. R. RITA* AND *S. R. COLORADENSIS*
(LYCAENIDAE)

OAKLEY SHIELDS

Department of Entomology, University of California,
Davis, California 95616

FROM A STUDY OF *SHIJIMIAEOIDES* (=PHILOTES) recently completed (Shields, 1975, and in press), there are a series of fairly discrete, allopatric *S. rita* (Barnes & McDunnough) subspecies that appear to gradually intergrade into one another at the perimeter of their ranges. This cline is expressed through phenotype, valve teeth counts, and foodplant preferences. I.e., *S. rita emmeli* Shields grades into *S. r. coloradensis* (Mattoni) and *S. r. rita* on the east and south and *S. r. pallescens* (Tilden & Downey) on the west, and *S. r. pallescens* grades into *S. r. elvirae* (Mattoni) on the west (see Fig. 1). *S. r. rita* and *S. r. elvirae*, although separated by only 200 miles, are at opposite ends of this spectrum. Likewise, *S. r. pallescens* and *S. r. spaldingi* (Barnes & McDunnough) in the Stansbury Mts., Utah, are very distinct. Preliminary data on chromosome counts of *S. rita* are variable: *S. rita emmeli* has $n = 33$, and *S. rita pallescens* has $n = 34$ (2 localities) and $n = 25$ (2 localities) (T. C. Emmel & O. Shields, unpublished).

In Shields (1975), I move *spaldingi* to the position of a *rita* subspecies since it possesses cristae on the valves. In that paper, possible ties of *spaldingi* with *r. rita* and *r. coloradensis* are assumed on morphological and foodplant similarities. *S. r. emmeli* flies only in areas of Triassic-Jurassic age sands, while *S. r. spaldingi* occupies regions of Upper Cretaceous-Cenozoic age mostly, at higher, wetter elevations.

S. r. pallescens probably occurs in the little-collected region of central and southern Nevada to western Utah and north-

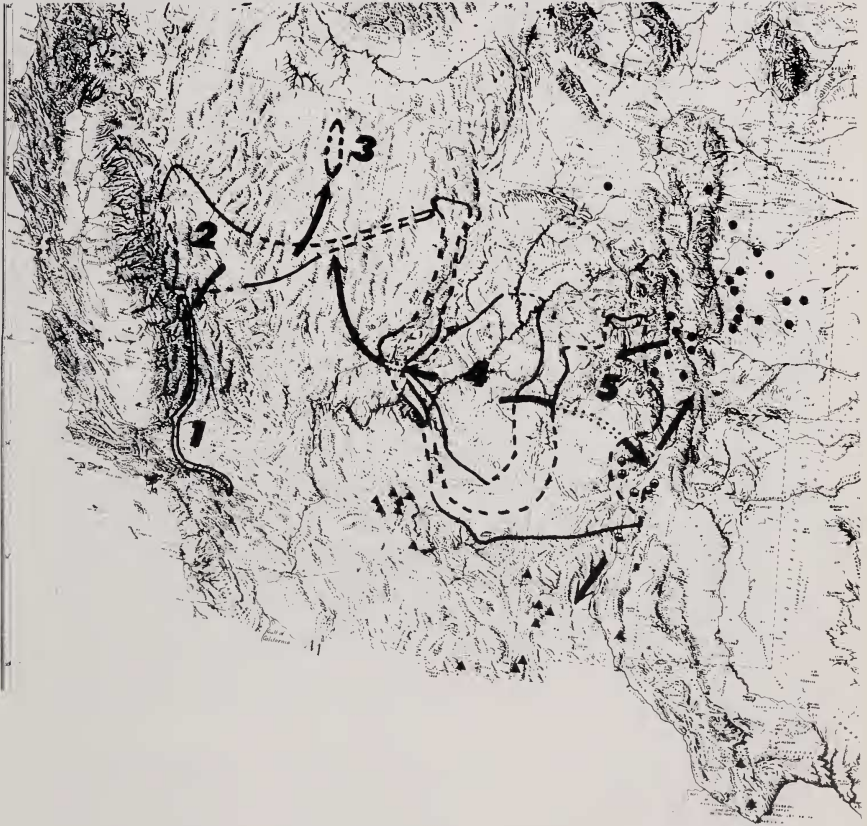


Fig. 1.—Distribution of *Shijimiaeooides rita* subspecies. 1 = *S. r. elvira*, 2 = *S. r. pallescens*, 3 = *S. r. mattonii*, 4 = *S. r. emmeli*, 5 = *S. r. spaldingi* (from Shields, 1975, and in press). Black triangles = *S. r. rita*, black circles = *S. r. coloradensis*, half-shaded circles = intergrade populations. Arrows denote presumed evolutionary trends.

western Arizona, where *E. kearneyi* Tidest. is found on sandy soils. *E. plumatella* Dur. & Hilg. grows in southeastern California to Mohave Co., Arizona, but so far *S. r. elvirae* has failed to turn up there.

Shijimiaeoides rita coloradensis (Mattoni)

Number of teeth on terminal end (cucullus) of valve = 23 (1), 24 (3), 25 (2), 26 (4), 27 (3), 28 (3), 29 (2), 30 (2), 35 (1); N = 21, average = 26-27, from Kendrick and Silver Cliff. For distribution, see appendix.

HOST: *Eriogonum effusum* Nutt. var. *effusum*. COLORADO: Chaffee Co.: Chalk Creek Trout Farm, viii-11-65, 1 ♂ (J. Scott, JS), adult association (Shields #138), Scott, Ellis, & Eff (1968) report oviposition on *E. effusum* in Fremont and Lincoln Cos., and adults on this species in Saguache Co. At the Lowry Bombing Range, Arapahoe Co., Colorado, *r. coloradensis* averages small and is in association with an annual *Eriogonum* species on overgrazed range land (fide Shapiro).

Eriogonum effusum var. *effusum* (see Fig. 2) is found in Pennington Co., South Dakota, southward into Converse and southern Niobrara Cos., Wyoming, southward in southeastern Wyoming and adjacent extreme western Nebraska to central and east-central Colorado in the Front Ranges and on the Great Plains to northern New Mexico from eastern San Juan County eastward to Union County and with an outlying population in Socorro County, New Mexico, flowering from June to September (Reveal, 1971).

Ssp. *coloradensis* is on wing from early July to late August.

S. r. coloradensis may be found in W. Kansas, SE Wyoming, and possibly W. Nebraska, as suitable habitats occur there or once did, although isolated and hard to locate in the farming areas according to Mike Fisher (*in litt.*). Scott, Ellis, & Eff (1968) give some records for *coloradensis*, repeated here.

Mattoni (1965) described *coloradensis* in detail for the first time and compared it with "rather similar" *rita rita*. From the results of this study, *coloradensis* and *r. rita* are distinguishable but closely related subspecies that intergrade in north-central New Mexico. Mattoni (1965) gives some distribution records for both.

Shijimiaeoides rita rita (Barnes & McDunnough)

Number of teeth on terminal end (cucullus) of valve = 21 (1), 22 (1), 23 (1), 24 (3), 25 (1), 26 (3), 27 (1), 28 (3), 29 (1), 31 (1); N = 16, average = 26, all from Ramsey Canyon.

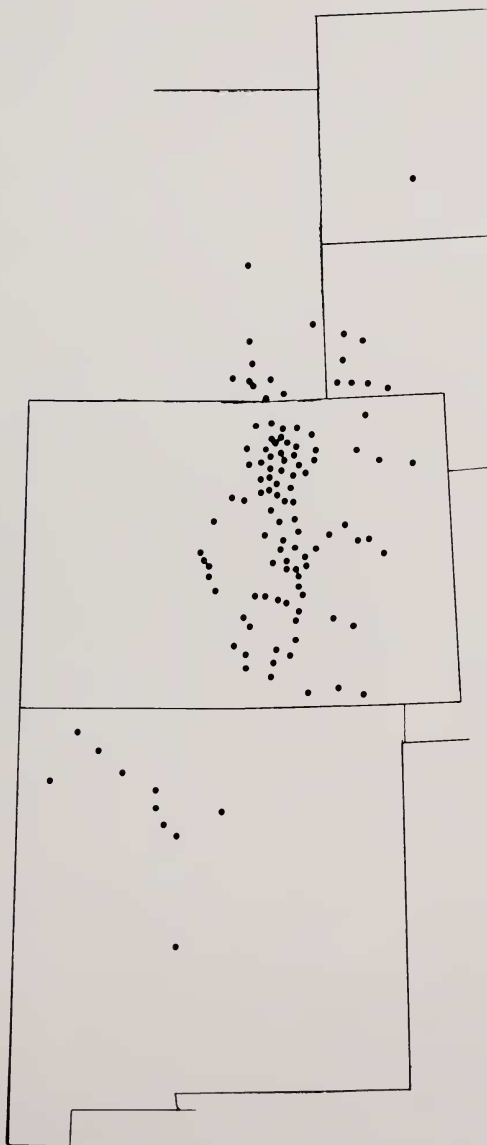


Fig. 2.—Distribution of *Eriogonum effusum* var. *effusum* (from Reveal, 1971).

For distribution and hosts, see appendix.

Kendall (*in litt.*) says he found larvae of *rita rita* on *E. wrightii* in the flats below Panther Canyon, Big Bend National Park, Brewster Co., Texas, in 1971. In 1972, he found one larva on this plant in Green Gulch, and one larva and two adults on this plant in the approach to Pine Canyon, both in Big Bend N. P. Comstock (1953) described the egg of *rita rita* and compared it with *enoptes dammersi* (Comstock & Henne).

E. wrightii var. *wrightii* is found in southeastern California eastward to western Texas southward to northern Mexico, flowering from July to September. *E. polycladon* occurs from extreme south-central Utah and Arizona across New Mexico to western Texas southward to northern Mexico, flowering from July to October. *E. rotundifolium* ranges from northern New Mexico southward to Chihuahua, Mexico, eastward into central Texas and Coahuila, Mexico, flowering from April to October. (The above information was drawn from Reveal, 1969.) *E. corymbosum* var. *velutinum* is probably only casually used by *rita*, as varieties of the species *corymbosum* are widely used by *battoides ellisii* Shields on the Colorado Plateau (Shields, 1975).

Ssp. *r. rita* is on wing from mid August to late September.

S. r. rita may range into northern Mexico on *E. wrightii*, but in southeastern California, extreme southern Nevada, and central Arizona it is replaced by *S. enoptes dammersi*. In the vicinity of Cherry and Hillside, Yavapai Co., Arizona, both are sympatric and synchronic. North, west, and east of the range of *S. r. rita* in the vicinity of Prescott, *S. enoptes dammersi* flies over *E. wrightii* at Stanton, Jerome, Mingus Mtn., Sycamore Canyon, Poland Jct., Montezuma Well, Verde Hot Spgs., Tonto Natural Bridge, East Verde River nr. Payson, and Sunflower.

Clench (1967) mentions the Silver City, Grant Co., N. M., record and the Rio Verde Mts. being NE of Phoenix, for *rita rita*.

A specimen of *r. rita* from the Huachuca Mts., Cochise Co., Arizona, no date (AMNH) labelled "*P. rita* B. & McD., identified by Barnes & McDunnough," one male, bears a red label "Metatype"; also from this locality at AMNH are 1 ♂ 1 ♀ "ex Barnes Collection," the female bearing the date VIII-16-23. For a discussion of the taxonomy of *rita rita*, see Mattoni (1965) and Shields (1975).

The "*Philotes rita*" reported by Garth (1944) from the southern slopes of the Ajo Mts., Pima Co., Arizona, in April on

Eriogonum fasciculatum Benth. is most likely *S. battoides martini* (Mattoni).

Populations in Sandoval and Santa Fe Cos., New Mexico, are best characterized as clinal between *r. rita* and *r. coloradensis*. At 13 mi. N. Lemitar, Socorro Co., N. M., the majority of specimens are typical *rita rita* but some trend toward *r. coloradensis*. A short series from SW of Cuba, Sandoval Co., tends smallish and appears to be a mixture of *rita rita*, *r. coloradensis*, and *r. emmeli*. A large female *S. rita* ssp. from Uinta Canyon, Duchesne Co., Utah, viii-4-59 (J. C. Downey, CIS) is probably near *emmeli* or *coloradensis* although it is not readily classed in either category.

The *S. rita* complex is chiefly confined to the primitive species of the *Eriogonum* subgenus *Eucycla*, ranked as the most primitive subgenus by Reveal (1969). The Colorado Plateau in southeastern Utah is likely the place of origin of *Eucycla* by virtue of its concentration of endemic species, evolving in the Triassic-Jurassic sand-dune deserts (Shields, 1975). Following the phylogenetic *Eriogonum* classification of Reveal (1969, 1971), *S. r. emmeli* on primitive *E. leptoclodon* Torr. & Gray would be the presumed originator of the *S. rita* complex, giving rise to *S. r. pallescens* on *E. kearneyi* and *S. r. coloradensis* on *E. effusum* (Fig. 1 & Table 1). In turn, *S. r. pallescens* produced *S. r. elvirae* on *E. plumatella* and *S. r. mattonii* Shields on *E. microthecum* Nutt., and *S. r. coloradensis* gave rise to *S. r. rita* on *E. wrightii*. The derivation of *S. r. spaldingi* on *E. racemosum* Nutt. from *S. r. coloradensis* would have occurred latest in the sequence, in Late Cretaceous or Early Tertiary times.

ACKNOWLEDGEMENTS

I wish to thank the following people for loaning material used in this study: (AM) Allyn Museum of Entomology, Lee D. Miller; (AMNH) American Museum of Natural History, Frederick H. Rindge; (RB) Richard Bailowitz; (CAS) California Academy of Sciences, Paul Arnaud and Thomas W. Davies; (CIS) California Insect Survey, Robert L. Langston and Jerry A. Powell; (CM) Carnegie Museum, Harry K. Clench; (SE) Scott Ellis; (CF) Clifford Ferris; (MF) Michael Fisher; Paul Grey; (KH) Keith Hughes; (RK) Roy Kendall; (NL) Noel La Due; (LACM) Los Angeles County Museum of Natural History, Julian P. Donahue; (MCZ) Museum of Comparative Zoology, Harvard, John Burns; (PO) Paul A. Opler; (KR)

Kilian Roever; (JS) James A. Scott; (CS) Charles Sekerman; Arthur M. Shapiro; and (YU) Yale University, Douglas C. Ferguson and Charles L. Remington. Mike Fisher assisted in constructing the distribution map of *S. r. coloradensis*. Dr. James L. Reveal of the University of Maryland kindly identified all the *Eriogonum* species and deposited voucher specimens at the National Arboretum in Washington, D.C. I thank John Lane for reviewing the manuscript and offering helpful suggestions. This work was supported in part by a grant from the Allyn Museum of Entomology (Arthur Allyn) and an N. S. F. Graduate Traineeship.

LITERATURE CITED

- CLENCH, H. K. 1967. Further distribution records and taxonomic notes on *Philotes rita* (Lycaenidae). *J. Lepid. Soc.* 21: 141-142.
- COMSTOCK, J. A. 1953. Life history notes on four southern Arizona butterflies. *Bull. So. Calif. Acad. Sci.* 52: 127-136.
- GARTH, J. S. 1944. Butterflies of the Organ Pipe Cactus National Monument, Arizona. *Ent. News* 55: 119-124.
- MATTONI, R. H. T. 1965. Distribution and pattern of variation in *Philotes rita*. *J. Res. Lepid.* 4: 81-102.
- REVEAL, J. L. 1969. A revision of the genus *Eriogonum* (Polygonaceae). Ph.D. dissertation, Brigham Young Univ.; Univ. Microfilms, Inc., Ann Arbor, Michigan. 70-4714.
- . 1971. Notes on *Eriogonum*—VI. A revision of the *Eriogonum microthecum* complex (Polygonaceae). *Brigham Young Univ. Sci. Bull.*, Biol. Ser. 13(1): 1-45.
- SCOTT, J. A., S. L. ELLIS, & D. EFF. 1968. New records, range extensions, and field data for Colorado butterflies and skippers. *J. Lepid. Soc.* 22: 159-171.
- SHIELDS, O. 1975. Studies on North American *Philotes* (Lycaenidae). IV. Taxonomic and biological notes, and new subspecies. *Bull. Allyn Mus.* no. 28, 36p.
- . 1977. Studies on North American *Philotes* (Lycaenidae). V. Taxonomic and biological notes, continued. *J. Res. Lepid.* 16: 1-67.

TABLE 1.

Variation in teeth number on terminal end (cucullus) of male valve in *Shijimiaeoides rita* subspecies (Shields, 1975, and in press).

	Average	Range	Sample Size
<i>S. rita coloradensis</i>	26-27	23-35	21
" " <i>spaldingi</i>	13-15	11-18	35
" " <i>rita</i>	26	21-31	16
" " <i>emmeli</i>	20-22	20-26	18
" " <i>pallescens</i>	17-19	11-24	41
" " <i>mattonii</i>	—	15-19	3
" " <i>elvira</i>	16	13-19	10

APPENDIX

Shijimiaeooides rita coloradensis (Mattoni)

DISTRIBUTION (viewed 27♂ gen. from 13 localities):

COLORADO: Adams Co.: 1 mi. E Bennett, 5750', viii (MF).

Alamosa Co.: entrance to Great Sand Dunes Nat'l Mon., viii-17-64, 1♂ (J. F. Emmel, AM). Arapahoe Co.: 0.4 mi.

E Boxelder Crk., 6000', ca. 20 mi. SE Denver, viii (MF);

Lowry Bombing Range, 6000', viii-5-73, 3♂ 1♀ (A. M. Shapiro, AM).

Chaffee Co.: Salida, vii-29-67, 2♂ (J. Scott, JS).

Cheyenne Co.: Aroya (spelled "Arroyo"), viii-21-34, 1♀

(C. L. Remington, YU). Custer Co.: 1/4 mi. NW Ben West Hill,

vii-25-65, 5♂ (J. Scott, JS, PO); 1/2-1 mi. S Silver Cliff,

viii-7 & 8-65, 15♂ 2♀ (J. Scott, JS, LACM); 2 mi. N Silver

Cliff, vii-18-65, 1♂ 1♀ (J. Scott, JS); 1.5 mi. NW Westcliff,

vii-25-65, 1♂ 1♀ (J. Scott, JS). Elbert Co.: 5-6 mi. E Kiowa,

6300', viii (MF). El Paso Co.: 10 mi. E. Colorado Springs,

Hwy. 94, 6000' (MF); Fountain Valley School & vicinity east

(F. M. Brown, MF); along Hwy. 94 E. of #14, including nr.

Ellicott, Rush, Yoder (MF); locals between Hwy. 94 & north

to Hwy. 24 (Rush to Ramah) along the "Ramah" Hwy. and west

to Peyton and north on county road toward Elbert, slightly

into Elbert Co., distribution fairly continuous from Hwy. 94

north to near Kiowa, first week of August 1973 (MF).

Fremont Co.: nr. Cotopaxi, viii-5-69, 1♂ 1♀ (MF); 1/2 mi.

NW to 1 mi. W Democratic Mtn., viii-20-65, 1♂ 1♀

(J. Scott, JS); 2 mi. N Hillside, viii-24-68, 1♂ 3♀

(J. Scott, JS); Hillside Cemetery, viii-17-65, 5♂ 2♀

(J. Scott, JS, LACM); 1/2 mi. E Hillside Cemetery, viii-17-65,

1♀ (J. Scott, JS); Hillside School, viii-17 & 23-65, 1♂¹ 8♀
 (J. Scott, JS, LACM); Kuntz Gulch, 1 mi. W Cotopaxi, viii-16-65,
 2♂¹ 2♀ (D. Eff, JS, LACM); mouth of Kuntz Gulch, viii-15-65,
 12♂¹ 17♀ (J. Scott, JS, PO, LACM); McCoy Gulch, 6800',
 viii-16-65, 2♂¹ 4♀, (J. Scott, JS, PO, LACM). Lincoln Co.:
 nr. Jct. 94 & 71 on Hwy. 94 (MF); 2-5 mi. E Arriba & I-70 east
 of there in Kit Carson Co., 5000-5100', viii (MF).
Rio Grande Co.: "D" Hill, Del Norte, vii-6-68, 1♀ (S. Ellis, SE).
Saguache Co.: 2 mi. SW Villa Grove, vii-18-66, 5♂¹ 6♀
 (J. Scott, PO, JS); 4 mi. S Villa Grove, vii-22-69, 6♂¹ 13♀,
 (J. Scott, JS). Washington Co.: 5 mi. W Last Chance, 5500',
 viii (MF). Weld Co.: Hilltop along I-80S (now I-76) 2 mi.
 S. of Empire Resvr., 5000' (MF); IBP site, E. of Nunn, vii,
 and vic. of Pawnee Buttes (International Biome Project,
 Research Facility, fide Fisher).

WYOMING: Albany Co.: T.15N., R.73W., 7500', vii-9 &
 12-72, 2♂¹ (C. D. Ferris, CF). Sweetwater Co.: 25 mi.
 S Bitter Creek, vii-15 & viii-1-42, 2♂¹ 2♀ (CM).

Shijimiaeoides rita rita (Barnes and McDunnough)

DISTRIBUTION (viewed 43♂¹ gen. from 15 localities):

ARIZONA: Cochise Co.: Huachuca Mts., viii-16-23, 2♂¹ 1♀ (AMNH);
 Ramsey Canyon, Huachuca Mts., viii, ix, 106♂¹ 68♀ (CIS, NL, LACM,
 AMNH, AM, PO, JS); Ramsey Canyon, 2 mi. SW of Route 92, 5300',
 Huachuca Mts., ix-7-59, 3♂¹ 1♀ (K. Roever, KR). Maricopa Co.:
 "Rio Verde Mts.", Phoenix, "Aug. 1893", 2♂¹ (CM). Yavapai Co.:
 Cherry, viii-19-53, 2♂¹ 1♀ (J. W. Tilden, AMNH); Cleator, viii-24-74,
 1♂¹ (R. Bailowitz, RB); 1 mi. N. Granite Dells, viii-16-76,
 1♂¹ 1♀ (R. Bailowitz, RB); 1 mi. S Hillside, ix-20-71, 2♂¹

Peoples Valley, viii-24-76, 1♂ 1♀ (R. Bailowitz, RB); 6 mi. NW Prescott, viii-21-76, 1♀ R. Bailowitz, RB); (C. Goodpasture, AM); Humboldt, viii-26-53, 3♀ (J. W. Tilden, AMNH); Yarnell, viii-21-60, 7♂ 4♀ (K. C. Hughes, KH, PO, CIS). County undetermined: "So. Arizona. Poling.", 2♂ 2♀ (CAS, MCZ). NEW MEXICO: Dona Ana Co.: San Agustin Pass, Organ Mts. E of Las Cruces, viii-24-72, 4♂ 4♀ (L. P. Grey, AM). Hidalgo Co.: ca. 11 rd. mi. NW Cloverdale, ca. 5500', Coronado Nat'l For., Peloncillo Mts., viii-24-70, 1♀ (S. L. Ellis, O. Shields, & M. E. Toliver, AM). Grant Co.: Silver City, viii-13-?, 1♂ (J. B. Wallis, CM). TEXAS: Brewster Co.: 21 mi. S Alpine, ix-20-70, 2♀ (J. Scott, JS); Big Bend Nat'l Park, ix-25 & 27-71, ex larvae, 1♂ 1♀ (R. O. & C. A. Kendall, RK); Panther Canyon, Big Bend Nat'l Park, ix-25-71, 1♀ (R. O. & C. A. Kendall, RK); Pine Canyon, Big Bend Nat'l Park, ix-27-72, 1♂ 1♀ (R. O. & C. A. Kendall, RK).

HOSTS AND DISTRIBUTION: Eriogonum wrightii Torr. ex Benth. in DC. var. wrightii. ARIZONA: Cochise Co.: jct. of Ramsey Canyon Rd. & Hwy. 92, 6.0 mi. S of jct. of Hwys. 90 & 92, SE of Ft. Huachuca, vii-28-70, one larva on flowers, adults taken commonly here in past (O. Shields) (Shields #125). Yavapai Co.: Mayer, viii-26-70, 1♂ 2♀ (C. A. Sekerman, CS), adult assoc., (area visited with L. Martin) (Shields #181). NEW MEXICO: Catron Co.: 1/2 mi. S Alma, 5600', ix-11-72, 1♂ (O. Shields, AM), adult assoc. (Shields #246). Hidalgo Co.: 22.0 rd. mi. S Animas, ca. 4900', along Hwy. 338, Animas Valley, viii-24-70, 5♂ 1♀ (S. L. Ellis, O. Shields, M. E. Toliver, AM), adult assoc. (Shields #153); ca. 13-14 rd. mi. NE Lordsburg, along

Hwy. 90, viii-25-70, 31♂¹ 22♀ (S. L. Ellis, O. Shields, M. E. Toliver, AM), adult assoc. (Shields #155), although most adults at this locality were roosting on Eriogonum polycladon (Shields #154). Eriogonum polycladon Benth. in DC. NEW MEXICO: Grant Co.: W edge of city limit of Central, along Hwy. 180, viii-26-70, 3♀ (O. Shields, M. E. Toliver, AM), oviposition (Shields #157); 18 rd. mi. WNW of Silver City, along Hwy. 180, viii-26-70, 2♂¹ 1♀ (O. Shields, M. E. Toliver, AM), adult assoc. (Shields #158).

(Clinal populations between rita rita and rita coloradensis): Eriogonum effusum Nutt. var. effusum. NEW MEXICO: Sandoval Co.: 2.0 rd. mi. SW of jct. 44 & 85, ca. 5000', along Hwy. 85 (SW of Bernalillo), viii-19-70, 4♂¹ 2♀ (S. L. Ellis, O. Shields, M. E. Toliver, AM), adult assoc. (Shields #150); 8.0 rd. mi. SW of jct. of 197 & 44 (SW of Cuba), along Hwy. 197, viii-18-70, 4♂¹ 2♀ (S. L. Ellis, O. Shields, AM), adult assoc. (Shields #149); 18 rd. mi. NW San Ysidro, along Hwy. 44, viii-18-70, 1♂¹ (S. L. Ellis, O. Shields, AM), adult assoc. (Shields #148). Santa Fe Co.: 8.4 rd. mi. NE of Cerrillos, ca. 6100', along Hwy. 10, viii-17-70, 1♂¹ 1♀ (S. L. Ellis, O. Shields, AM), adult assoc. (Shields #144); 10.8 rd. mi. NE of Cerrillos, ca. 6200', along Hwy. 10, viii-17-70, 1♂¹ 1♀ (S. L. Ellis, O. Shields, AM), adult assoc. (Shields #143). Socorro Co.: 13 rd. mi. N of Lemitar, ca. 5000', at La Joya State Game Refuge exit of Hwy. 25, viii-21-70, 25♂¹ 6♀ (S. L. Ellis, O. Shields, M. E. Toliver, AM), oviposition (Shields #151), and adults also in association with Eriogonum rotundifolium Benth. in DC. (Shields #152). Eriogonum corymbosum Benth. in DC. var. velutinum Reveal. NEW MEXICO: Santa Fe Co.: 1.1 rd. mi. SW of Cerrillos, ca. 5800', along Hwy. 10, viii-17-70, 1♂¹ (S. L. Ellis, O. Shields, AM), adult assoc. (Shields #145).